BTEC Assignment Brief

Qualification	Pearson BTEC International Level 3 Diploma in Civil Engineering Pearson BTEC International Level 3 Extended Diploma in Civil Engineering
Unit number and title	Unit 29: Principles and Applications of Structural Mechanics
Learning aim(s) (For NQF only)	A: Understand the principles of structural behaviour under load
Assignment title	Investigate the behaviour of structural members under load
Assessor	
Issue date	
Hand in deadline	
Vocational Scenario or Context	You are a trainee civil engineer working in a large civil engineering consultancy company. You are based in the structural design team and are required to complete calculations and demonstrate understanding of how structural components may be designed and factors to be considered in their design. Your supervisor has monitored your progress and is impressed by your knowledge and understanding of structural mechanics. You have been requested to produce a written report which could be used to introduce the behaviour of structural members under load to assist future trainees understand key considerations when designing structural components.
Task 1	You are to produce a written report which a) examines the behaviour of structural elements under load b) Investigates how structural members are likely to fail. **To do this:** 1. You are required to complete the following three tables and calculations to show your understanding of structures and forces: 1.1 Make a table, as shown below, and draw a sketch and write a short description to describe each of the structural elements:

	Structural member	Sketch of the structural member and description of how it carries loads
1.	Beam	
2.	Column	
3.	Strut	
4.	Tie	

1.2. Make a table containing the types of load, as shown below, and complete it by writing the meaning of each load type:

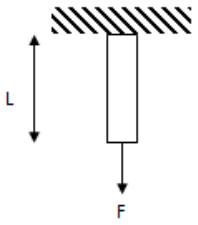
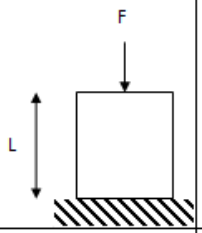
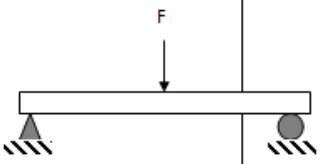
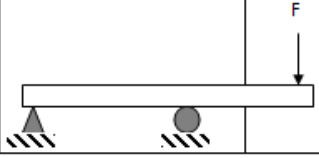
	Term	Meaning
1.	Dead Load	
2.	Imposed Load	
3.	Wind Load	
4.	Point Load	
5.	Uniformly Distributed Load	

1.3. Make a table, as shown below, and draw what is meant by each type of force alignment as stated in the table:

	Term	Drawing showing the layout of forces
1.	Coplanar concurrent forces	
2.	Coplanar non-concurrent forces	

2. You are required to complete the following two tables to demonstrate your knowledge of how structures deflect or deform under load:

2.1 Complete the table below-

	Structure	Deformed Shape
1.		
2.		
3.		
4.		

2.2 Make a table as shown below and draw a sketch to explain what is meant by the description for shear forces within a beam:

	Term	Drawing describing the shear force in a beam
1.	Horizontal shear forces	
2.	Vertical shear forces	

3. The architect would like you to demonstrate your ability to think about a structural problem and to clearly present calculations that show your understanding of how to solve the problem. The following questions will allow the architect to assess your ability to present and solve structural calculations before progressing on to more detailed design work.

a) A 300 cm long steel rod having a diameter of 3 cm is subjected to an axial pull of 30 kN.
Determine the stress, strain and the elongation of the rod if the modulus of elasticity (E) of the steel rod is $2x10^5$ N/mm2.

b) A steel bar with sectional area 300 mm x 50 mm and 1.5m long is subjected to a pull of 225 kN in the direction of its length and stretches by 0.4 mm.
Assuming the material is elastic, determine the stress and strain in the rod.

c) A square timber section 200 mm was squashed by 0.02 mm from its original length of 1.2m when a load of 40 kN was applied.
Determine the young's modulus of elasticity E of the timber.

d) The tensile strength of a bar is 400 N/mm^2. If the permissible stress is 155 N/mm^2.
Determine its factor of safety.

You will:
Produce a report which includes-

- Your tables of diagrams and calculations above.
- An explanation of the difference between compressive,

	tensile, shear and bending stresses. • An interpretation of the behaviour of structural elements under given loading conditions, for given design conditions, at the point of failure.
Checklist of evidence required	A report will focus on structural elements behave under loading, and the different types of stress that result. You should include diagrams, sketches and calculations to provide examples in your report.
Criteria covered by this task:	
Unit/Criteria reference	To achieve the criteria you must show that you are able to:
29/A.P1	Describe the behaviour of structures under loads
29/A.M1	Assess the behaviour of structures under loads for given design conditions
29/A.D1	Interpret the likely behaviour, under load, of structural elements, for given design conditions, at the point of failure
Sources of information to support you with this Assignment	Books BTEC Level 3 National Construction and the Built Environment Student Book; Topliss et al; Edexcel, London (2010); ISBN 1846906555 Websites www.thelearningpoint.net/home/engineering-mechanics/analysis-of-structures www.structuralconcepts.org **resources may be found at** qualifications.pearson.com/en/support/published-resources.html
Other assessment materials attached to this Assignment Brief	

Note to assessor:

Scenario	Each cohort of learners should be provided with different numerical values for dimensions and loadings of the various structural members. Ideally individual learners should be provided with their individualised data to complete their analysis.